CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

What is claimed is:

1. (Previously Presented) A rotary cone bit comprising:

a steel bit body comprising at least one leg extending therefrom;

a steel cone rotatably disposed on the leg, the cone comprising a plurality of cutting elements projecting outwardly therefrom;

wherein one or more of the cutting elements comprises a steel base portion projecting outwardly a distance from the cone, and an end portion attached to the base and extending therefrom to form a tip of the cutting element, wherein the end portion is a substantially solid part and is formed from a wear resistant material, wherein the end portion is made by the process of:

combining powders selected from the group consisting of carbides, borides, nitrides, carbonitrides, refractory metals, cermets, Co, Fe, Ni, steel, and combinations thereof, to form a material mixture;

shaping the material mixture into the form of the end portion; and

applying the shaped material mixture onto the base when the base is in a pre-existing rigid state and is part of the cone.

2. (Previously Presented) The bit as recited in claim 1 wherein the end portion and the base include adjacent interfacing surfaces having complementary surface features to facilitate attachment therebetween.

3. (Previously Presented) The bit as recited in claim 1 wherein before the step of applying, the end portion is pressurized under elevated temperature conditions to form the wear resistant material, and wherein the step of applying is provided by brazing.

4. (Previously Presented) The bit as recited in claim 1 wherein the wear resistant material has a material microstructure comprising:

a first phase of grains that are selected from the group of carbides, borides, nitrides, and carbonitrides of W, Ti, Mo, Nb, V, Hf, Ta, and Cr refractory metals, carbides; and

a second phase of a binder material selected from the group consisting of Co, Ni, Fe, and alloys thereof.

5. (Previously Presented) The bit as recited in claim 4 wherein the wear resistant material comprises cemented tungsten carbide.

6. (Previously Presented) A rotary cone bit comprising:

a steel bit body comprising at least one leg extending therefrom;

a steel cone rotatably disposed on the leg; and

a plurality of teeth projecting outwardly away from the cone, at least one tooth comprising a steel base portion integral with the cone and projecting a distance outwardly therefrom, and a substantially solid end portion extending from the base portion to form a remaining portion and a tip of the tooth, the base and end portions being permanently attached together, the end portion being formed from a wear resistant material having a microstructure comprising:

a first phase of grains selected from the group of carbides, borides, nitrides, and carbonitrides of W, Ti, Mo, Nb, V, Hf, Ta, and Cr refractory metals; and

a second phase of a binder material selected from the group consisting of Co, Ni, Fe, and alloys thereof.

7. (Original) The bit as recited in claim 6 wherein the tooth base and end portion include interface surfaces comprising complementary attachment means for facilitating attachment therebetween.

8. (Original) The bit as recited in claim 7 wherein the end portion includes a base interface surface opposite from the tip and an attachment member projects outwardly therefrom, and the base includes an end portion interface surface comprising an attachment recess disposed therein for accommodating placement of the attachment member therein.

9. (Original) The bit as recited in claim 6 wherein the wear resistant composite material is WC-Co.

10. (Previously Presented) A method for making a wear resistant cutting element implant for attachment onto a cutting element base projecting from a rotary cone bit for drilling subterranean formations, the method comprising the steps of:

combining powders selected from the group consisting of carbides, borides, nitrides, carbonitrides, refractory metals, cermets, Co, Fe, Ni, steel, and combinations thereof to form a material mixture;

shaping the material mixture into the form of the implant that defines an end portion of the cutting element, wherein the cutting element base is made from steel and is integral with the rotary cone, the implant being substantially solid and comprising a tip at one and a base interface surface at an opposite end;

pressurizing the implant under conditions of elevated temperature to form the wear resistant material; and

attaching the implant to the base by welding when the cutting element base is in a pre-existing rigid state.

11. (Previously Presented) A rotary cone bit for drilling subterranean formations comprising:

a steel bit body having at least one leg extending therefrom;

a steel cone rotatably disposed on the leg, the cone comprising a plurality of cutting elements projecting outwardly therefrom;

wherein at least one of the cutting elements has a two-piece construction comprising:

a steel base that is integral with and that projects a distance outwardly from the cone; and

a substantially solid end piece that is attached to the base and that defines a remaining portion of the cutting element extending to a cutting element tip, wherein the end piece is formed from a wear resistant material comprising a first phase of grains selected from the group consisting of carbides, borides, nitrides and carbonitrides of W, Ti, Mo, Nb, V, Hf, Ta and Cr refractory metals, and a second phase of a binder material selected from the group consisting of Co, Ni, Fe and alloys thereof, wherein the end piece and the base have interfacing surfaces with complementary surface features to facilitate a cooperative attachment therebetween.

12. (Previously Presented) The rotary cone bit as recited in claim 11 wherein the end piece is attached to the base by a braze material.

13. (Previously Presented) The rotary cone bit as recited in claim 11 wherein one of the base or end piece interface surface includes a projecting surface feature that is configured to fit within a recessed surface feature of the other of the base or end piece interface surface.

14. (Previously Presented) The rotary cone bit as recited in claim 11 wherein the end piece is formed from WC-Co.

15. (Previously Presented) A method of making a wear resistant cutting element implant for attachment onto a base portion of a cutting element projecting from a rotary cone bit comprising the steps of:

combining powders selected from the group consisting of carbides, borides, nitrides, carbonitrides, refractory metals, cermets, Co, Fe, Ni, steel, and combinations thereof to form a material mixture;

shaping the material mixture into the form of an implant defines an end portion of the cutting element, wherein the cutting element base is made from steel and is integral with the rotary cone, the end portion being substantially solid and comprising a tip at one and a base interface surface at an opposite end;

placing the implant onto the cutting element base when the implant is in a pre-existing rigid state; and

pressurizing the implant under conditions of elevated temperature to form the wear resistant material and to attach the implant to the cutting element base.